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Abdi Taghi Abad et al.

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(54) **PASSWORD PROTECTION IN A COMPUTING ENVIRONMENT**

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H04L 9/40 (2022.01)

(52) **U.S. Cl.**
CPC ***H04L 63/083*** (2013.01); ***H04L 63/0876*** (2013.01)

(58) **Field of Classification Search**
CPC H04L 163/083; H04L 63/0876
See application file for complete search history.

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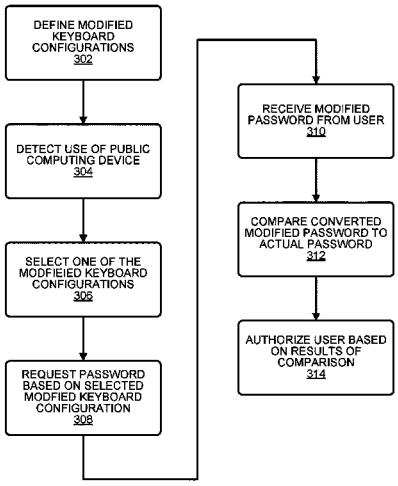
(74) *Attorney, Agent, or Firm* — KDW Firm PLLC

(57) **ABSTRACT**

Techniques for protecting passwords and/or password entry by a user are provided. User identification data for a user can be received from a remote computing device. An identity of the user can be determined based on the user identification data. A password for the user can be determined. A modified keyboard configuration associated with the user can be determined. A request can be transmitted to the remote computing device for the password for the user based on the modified keyboard configuration. A modified password from the remote computing device can be received. A converted password based on the modified password and the modified keyboard configuration can be determined. The converted password can be compared to the password for the user. The user can be authorized when the converted password matches the password for the user.

20 Claims, 7 Drawing Sheets



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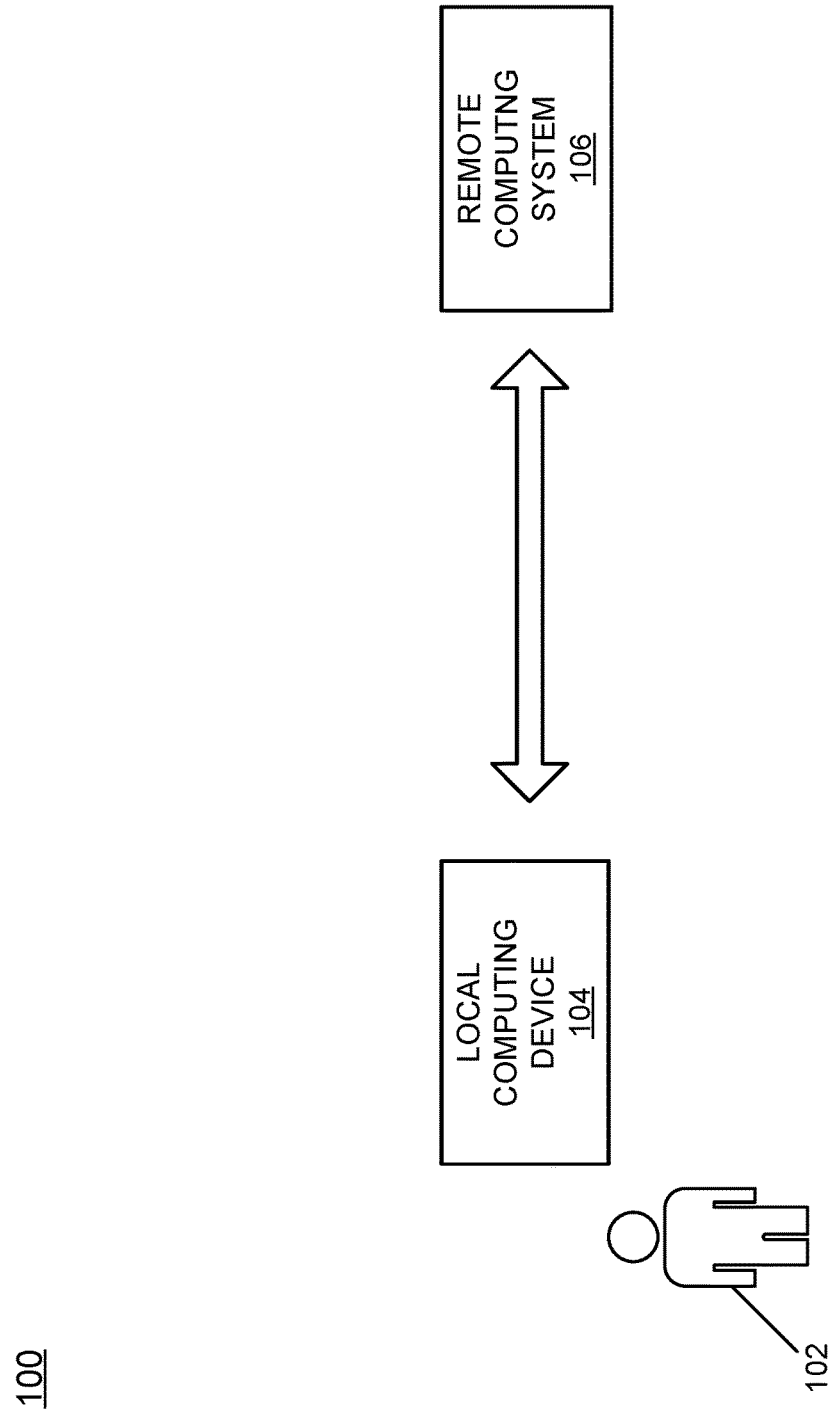
REMOTE COMPUTNG SYSTEM 106
LOCAL COMPUTING DEVICE 104
102
100

FIG. 1

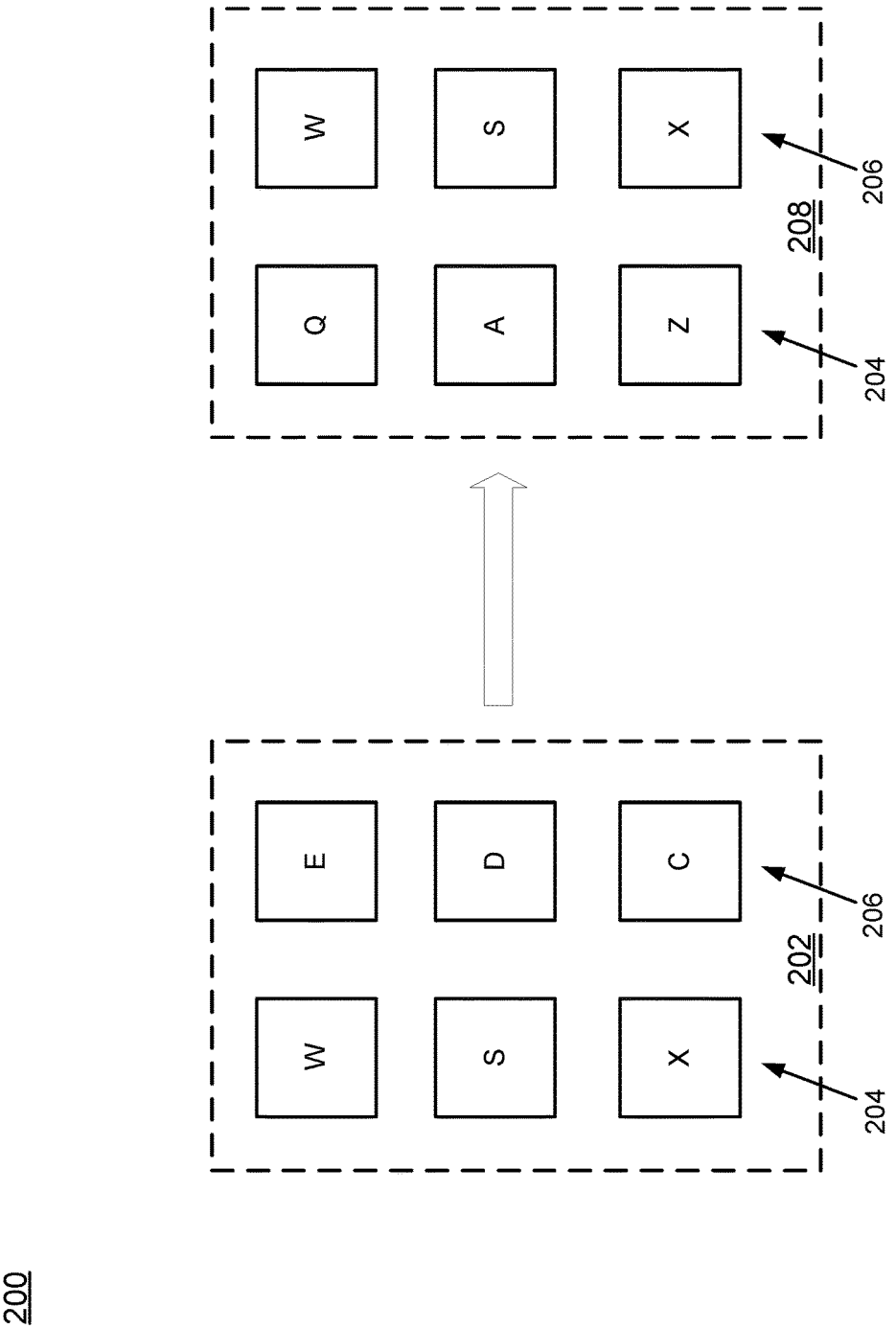

FIG. 2A

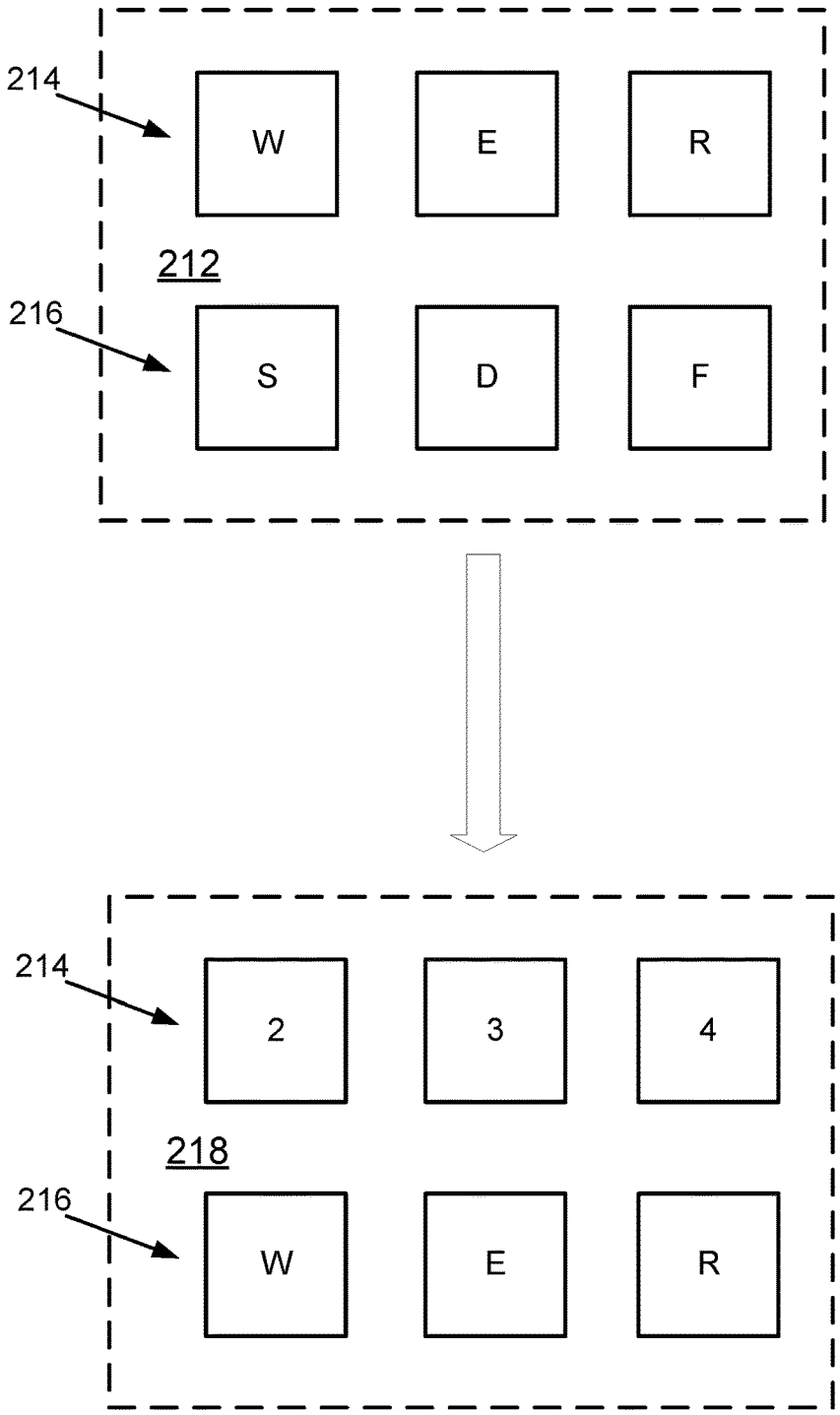

FIG. 2B

300

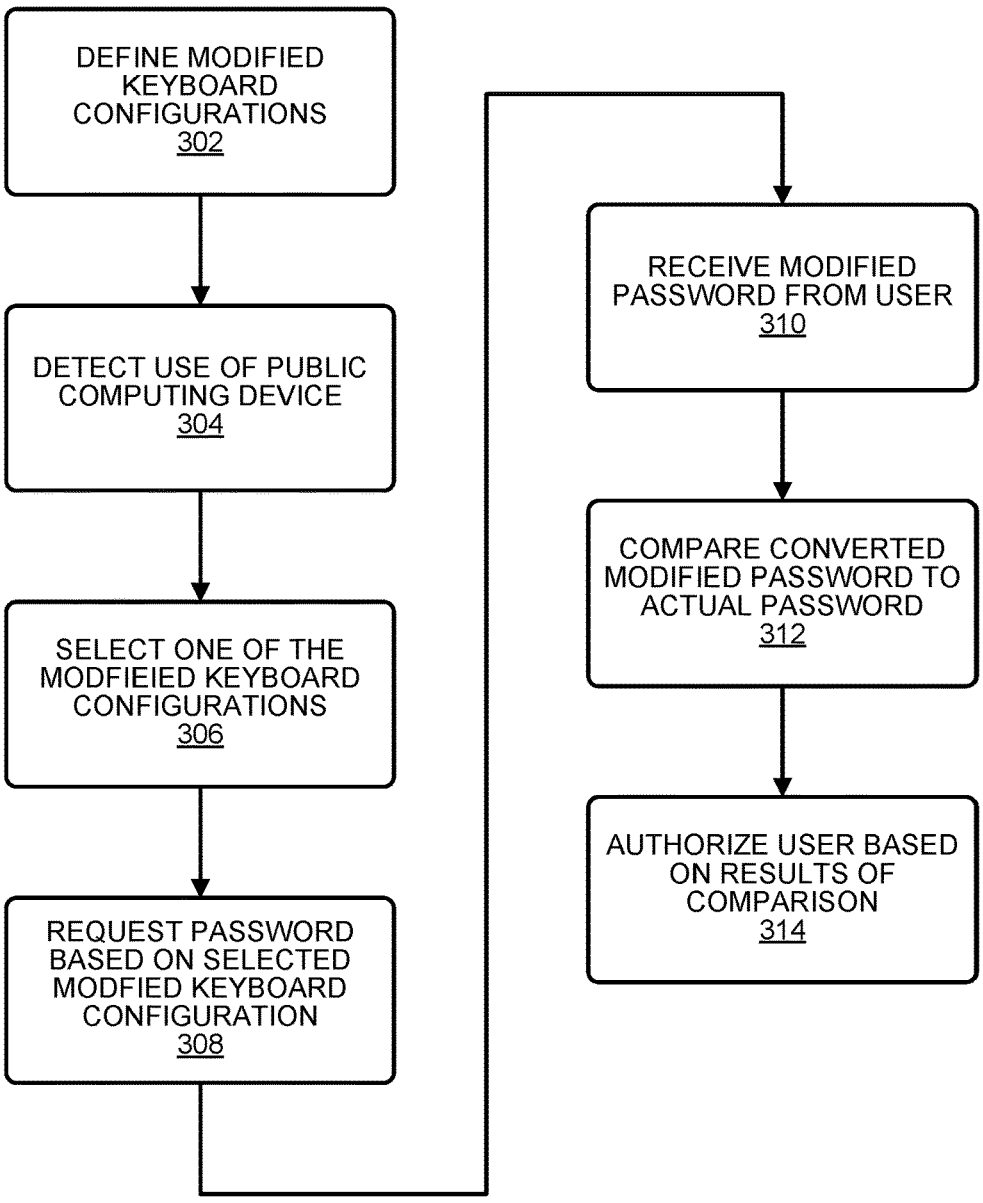
DEFINE MODIFIED KEYBOARD CONFIGURATIONS 302
DETECT USE OF PUBLIC COMPUTING DEVICE 304
SELECT ONE OF THE MODFIEIED KEYBOARD CONFIGURATIONS 306
REQUEST PASSWORD BASED ON SELECTED MODFIED KEYBOARD CONFIGURATION 308
RECEIVE MODIFIED PASSWORD FROM USER 310
COMPARE CONVERTED MODIFIED PASSWORD TO ACTUAL PASSWORD 312
AUTHORIZE USER BASED ON RESULTS OF COMPARISON 314

FIG. 3

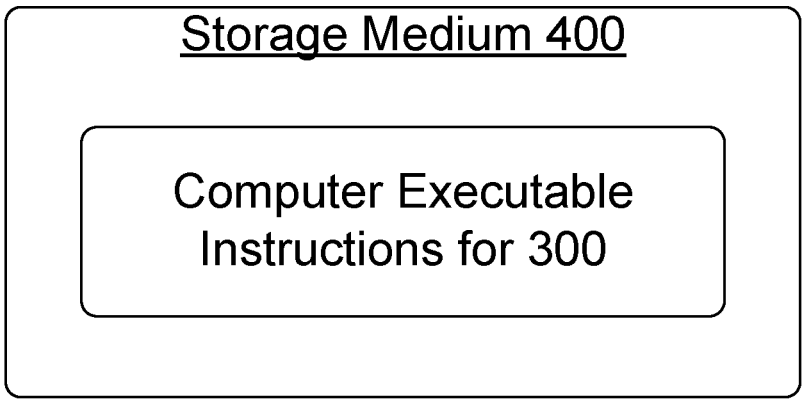
Storage Medium 400
Computer Executable Instructions for 300

FIG. 4

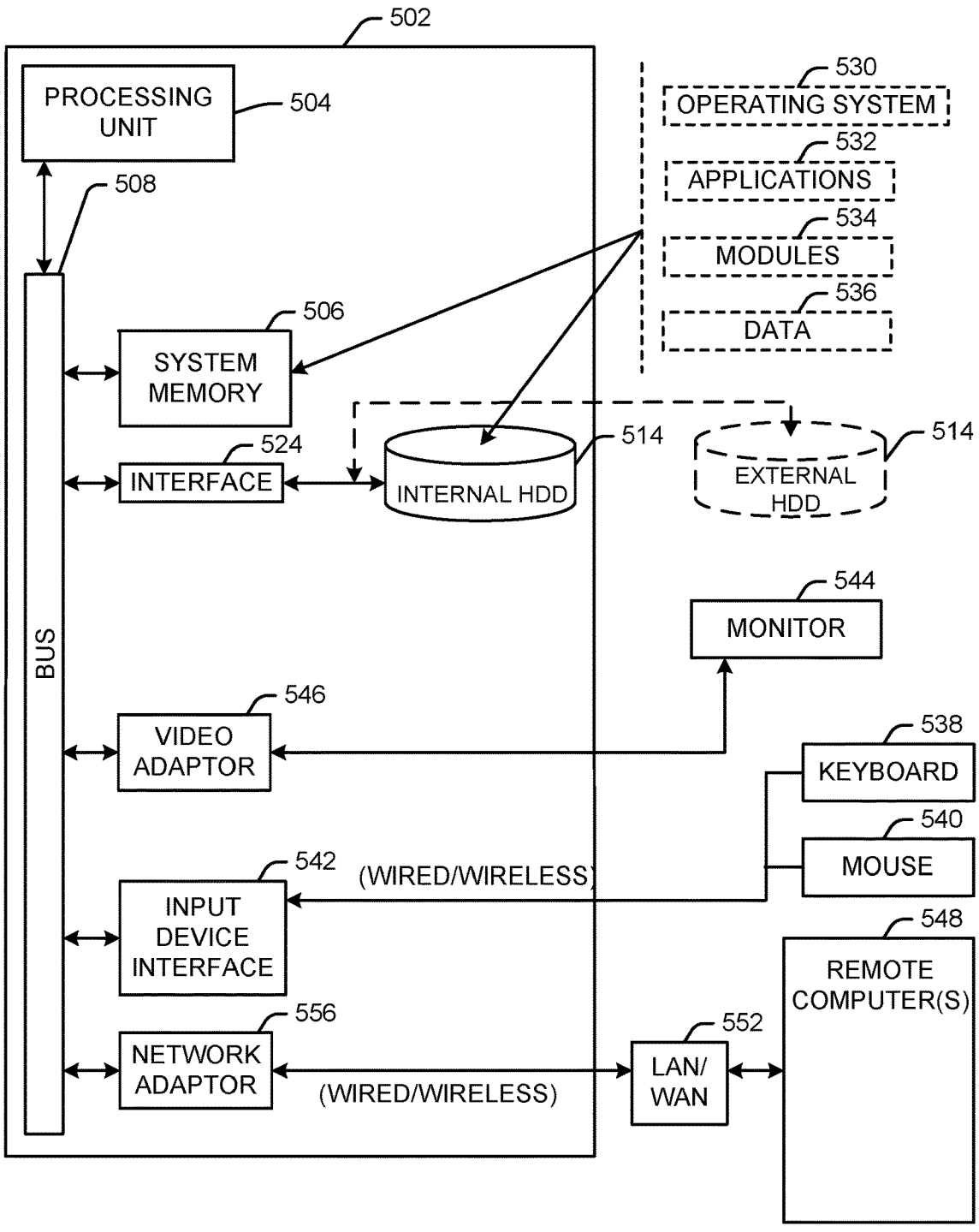
500
502
PROCESSING UNIT
504
508
BUS
506
SYSTEM MEMORY
524
INTERFACE
INTERNAL HDD
514
EXTERNAL HDD
514
530
OPERATING SYSTEM
532
APPLICATIONS
534
MODULES
536
DATA
544
MONITOR
546
VIDEO ADAPTOR
538
KEYBOARD
540
MOUSE
542
(WIRED/WIRELESS)
INPUT DEVICE INTERFACE
548
REMOTE COMPUTER(S)
556
NETWORK ADAPTOR
(WIRED/WIRELESS)
552
LAN/ WAN

FIG. 5

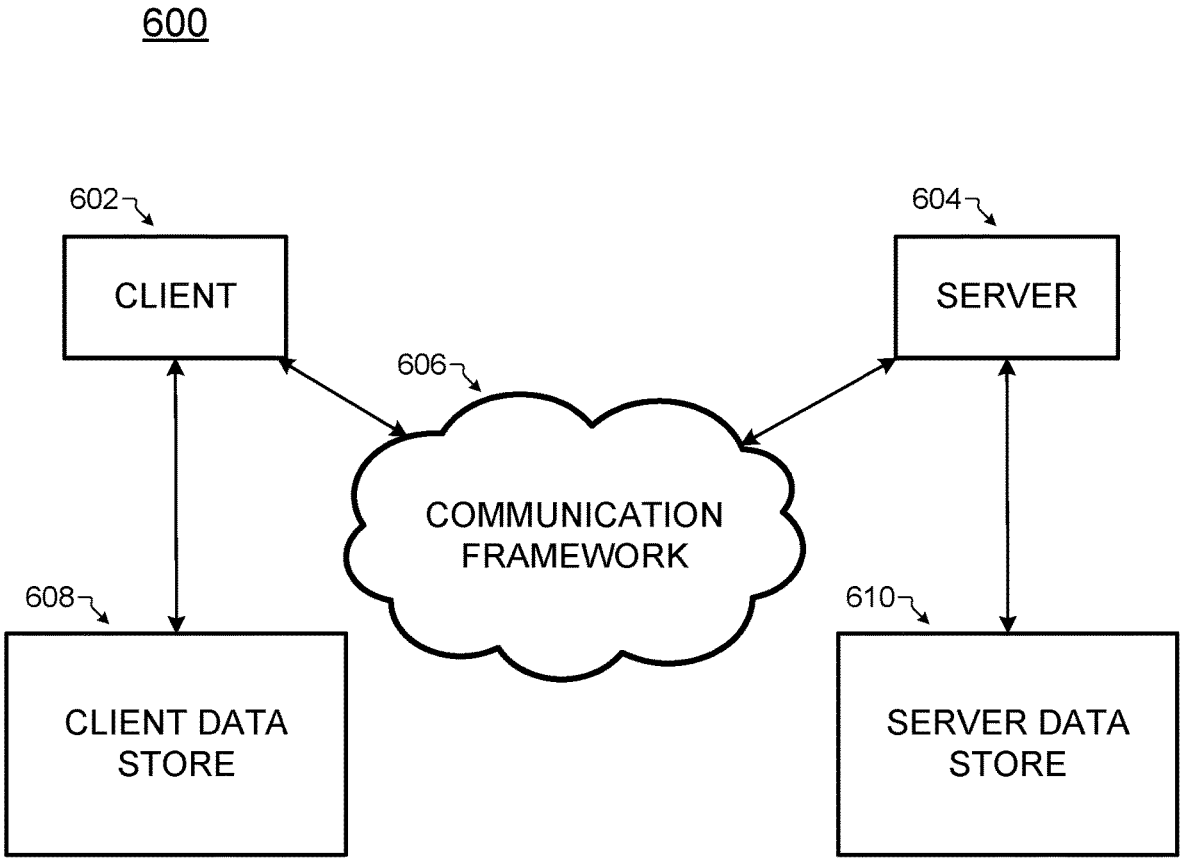
600
602
CLIENT
604
SERVER
606
COMMUNICATION FRAMEWORK
608
CLIENT DATA STORE
610
SERVER DATA STORE

FIG. 6

PASSWORD PROTECTION IN A COMPUTING ENVIRONMENT

RELATED APPLICATIONS

This application is a Continuation of U.S. patent application Ser. No. 16/554,726, filed on Aug. 29, 2019, which is a Continuation of U.S. patent application Ser. No. 16/424,713, filed on May 29, 2019 (issued as U.S. Pat. No. 10,440,011 on Oct. 8, 2019). The contents of both aforementioned patent applications are incorporated herein by reference in their entireties

TECHNICAL FIELD

Embodiments described herein generally relate to computer security.

BACKGROUND

Conventional techniques for authenticating a user typically involve a user entering a password through a computing device. Entering a password through a user interface of a computing device is often not secure and may allow other individuals to simply see the password the user enters (e.g., through a keyboard) or to record the password entry (e.g., through key logging). Given the vulnerabilities related to entering a password, what is needed are mechanisms for more secure entry of a password to protect a user's account and authentication of the user. In this manner, protection against malicious key loggers and/or activity recorders that may reside on the user's computing device can be prevented from obtaining the password of the user.

SUMMARY

This disclosure presents various systems, components, and methods related to providing password protection. Each of the systems, components, and methods disclosed herein provides one or more advantages over conventional systems, components, and methods.

Various embodiments provide techniques for protecting passwords and/or password entry by a user. User identification data for a user can be received from a remote computing device. An identity of the user can be determined based on the user identification data. A password for the user can be determined. A modified keyboard configuration associated with the user can be determined. A request can be transmitted to the remote computing device for the password for the user based on the modified keyboard configuration. A modified password from the remote computing device can be received. A converted password based on the modified password and the modified keyboard configuration can be determined. The converted password can be compared to the password for the user. The user can be authorized when the converted password matches the password for the user.

The password protection techniques described herein provide protection against malicious attacks against a user that attempt to steal a password of the user—either through simply directly observing the user enter the password or through a key logger or activity recorder resident on a computing device of the user. The password protection techniques described herein block correct capture of the user's password, thereby enhancing security and providing peace of mind to the user. Other embodiments are also disclosed and described.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates an operating environment.

FIG. **2**A illustrates a first modified keyboard configuration.

FIG. **2**B illustrates a second modified keyboard configuration.

FIG. **3** illustrates a logic flow.

FIG. **4** illustrates a storage medium.

FIG. **5** illustrates a computing architecture.

FIG. **6** illustrates a communication architecture.

DETAILED DESCRIPTION

FIG. **1** illustrates an operating environment **100** such as may be representative of various embodiments in which techniques for password protection are provided. The operating environment **100** can include a user **102**, a local computing device **104**, and a remote computing system **106**.

The local computing device **104** can be any type of electronic computing device such as, for example, a desktop, a laptop, a tablet, a notebook, or a mobile device. The local computing device **104** can be operated by the user **102**.

The remote computing system **106** can be any type of computing device including a server or can represent a computer network, a cloud-based computing system, a database, or any other computer networking component, electronic computing device, and/or storage device.

The local computing device **104** and the remote computing system **106** can be communicatively coupled such that any type of data or information can be shared between the local computing device **104** and the remote computing system **106** over any type of communications network. Each of the local computing device **104** and the remote computing system **106** may be communicatively coupled to any number of other local and/or remote devices, systems, or networks.

In various embodiments, the remote computing system **106** can provide a website or other web-based service accessible to the local computing device **104**. In various embodiments, the website provided by the remote computing system **106** can be restricted to only authorized users. For example, the user **102** can be required to enter a user identification (ID) (e.g., user identification data) and an associated password to gain access to information, content, and/or services provided by the website of the remote computing system **106**. The user identification and password for the user **102** can be part of a user account for the user **102**. Techniques described herein provide password protection mechanisms that improve security of the password associated for the user **102**.

In various embodiments, when the user **102** creates the user's account on the remote computing system **106**, the user **102** can generate a user ID (e.g., that uniquely identifies the user **102**) and a corresponding password. Further, as part of creating an account, the user can generate one or more modified keyboard configurations for entering the password on the local computing device **104**. In various embodiments, generation of the one or more modified keyboard configurations can be conducted when the local computing device **104** is a secure device and/or operates over a secure network. In various embodiments, when the local computing device **104** is not a secure device and/or does not operate over a secure network, then the remote computing system **106** can require the user to develop the modified keyboard configurations at a later time (e.g., the next time the user **102** logs on to the remote computing system **106** through a secure computing device and/or secure network).

In various embodiments, a non-modified or standard keyboard configuration can be a QWERTY keyboard configuration. In various embodiments, a modified keyboard configuration can be any keyboard configuration that varies from the standard keyboard configuration. The modified keyboard configuration can be a reassignment of keys of the standard keyboard configuration. In various embodiments, the reassignment of keys can be a one-for-one reassignment of all keys on the standard keyboard configuration. In various embodiments, the reassignment of keys can be a one-for-one reassignment of a subset of all keys on the standard keyboard configuration—for example, only alphabet keys, or only numerical keys, or any combination of certain alphabet keys and certain numerical keys.

In various embodiments, the modified keyboard configurations can be virtual configurations. That is, the modified keyboard configurations are not physical reconfigurations of any keyboard that is part of the local computing device **104**. Instead, the modified keyboard configurations can be virtual reassignment of keys of a keyboard. As an example, the characters or keys of a standard keyboard can be shifted to the right by one key for a first modified keyboard configuration. As a result, for example, the keys E-D-C can be shifted to the right to where the keys R-F-V are positioned. Accordingly, to enter "E," the user would hit the R key on the standard keyboard configuration. The remote computing system **106** would receive an indication that the R key was hit by the user **102**. The remote computing system **106** would then convert the received R character back to the E character based on the known modified keyboard configuration.

As another example, the characters or keys of a standard keyboard can be shifted down by one key for a second modified keyboard configuration. As a result, for example, the keys W-E-R can be shifted down to where the keys S-D-F are positioned. Accordingly, to enter "E," the user would hit the D key on the standard keyboard configuration. Again, the remote computing system **106** would receive an indication that the D key was hit by the user **102**. However, based on the known modified arrangement of the keyboard that the user **102** is operating under, the remote computing system **106** would convert the received D character into an E character, as intended to be provided by the user **102**. In this way, a modified keyboard arrangement can be used by the user **102** to enter characters that can be converted back to characters related to the standard keyboard configuration by the remote computing system **106**.

In various embodiments, the user **102** can define any number of modified keyboard configurations. The user **102** can define a modified keyboard configuration based on suggested configurations provided by the remote computing system **106**. In various embodiments, the user **102** can specify a name or identification for each modified keyboard configuration—for example, "first configuration," "second configuration," etc. The modified keyboard configurations can be stored by the remote computing system **106** and can be associated with the user **102** (e.g., stored as part of the account information for the user **102**).

In various embodiments, when the user **102** attempts to access the remote computing system **106** (e.g., the website provided by the remote computing system **106**), the remote computing system **106** can request the user **102** to provide user ID created when the account for the user was created. The remote computing system **106** can then use the provided login ID to identify the user **102**. Based on identifying the user **102**, the remote computing system **106** can determine the one or more modified keyboard configurations associated with the user **102**.

In various embodiments, the remote computing system **106** can determine if the local computing device **104** being used by the user **102** is a secure computing device or a public computing device. In various embodiments, a secure computing device can be considered to be secure if operating over a secure computer network and/or if the local computing device **104** has an IP address that is known to the remote computing system **106** (e.g., the IP address of the local computing device **104** matches a stored IP address associated with the user **102**). In various embodiments, a public computing device can be considered to be public if operating over a public computer network and/or if the local computing device **104** has an IP address that is not known to the remote computing system **106** (e.g., the IP address of the local computing device **104** does not match a stored IP address associated with the user **102**).

In various embodiments, the remote computing system **106** can request a password for the user **102** after determining if the local computing device **104** is a secure computing device or a public computing device. If the local computing device **104** is a secure computing device, the remote computing system **106** can request the password based on the standard keyboard configuration. Alternatively, if the local computing device **104** is a public computing device, the remote computing system **106** can request the password based on one of the predetermined and stored modified keyboard configurations associated with the user **102**.

In various embodiments, one of the modified keyboard configurations can be selected randomly. In various embodiments, after selecting a modified keyboard configuration, the remote computing system **106** can transmit a request to the local computing device **104** for the password of the user **102**. The request can indicate the selected modified keyboard configuration. For example, the request can indicate that the password for the user **102** is requested and should be entered based on certain specified keyboard configuration (e.g., based on a name specified by the user **102** at the time the modified keyboard configuration was defined). In response to the request, the user **102** can enter the password taking into account the specified modified keyboard configuration. For example, based on the first modified keyboard configuration keyboard, the user **102** can enter the password by hitting each key of the password shifted to the right by one key in comparison to the standard keyboard configuration.

In various embodiments, the password entered by the user **102** based on a designated modified keyboard configuration can be considered to be a modified password. For example, if the password for the user is "EDC" on the standard keyboard configuration, then for the first modified keyboard configuration described above, the user **102** would enter "RFV" in response to the keyboard request. The entered "RFV" can be considered to be a modified password (e.g., a first modified password corresponding to the first modified keyboard configuration).

In response to receiving the modified password, the remote computing system **106** can compare the modified password to the actual password for the user **102**. To do so, in various embodiments, the remote computing system **106** can convert the modified password "RFV" to a converted password "EDC" based on the first modified keyboard configuration. The remote computing system **106** can then compare the converted password to the stored password for the user **102**. If the converted password matches the stored password for the user **102**, then the remote computing

system **106** can authorize the user **102**—for example, can grant the user **102** access to the website provided by the remote computing system **106**. If the converted password does not match the stored password for the user, then the remote computing system **106** can block authorization of the user—for example, can prevent the user **102** from accessing the website provided by the remote computing system **106**.

In various embodiments, each modified keyboard configuration specified and/or defined by the user **102** can be used only a limited number of times (e.g., once). In various embodiments, any password information entered by the user **102** (either the actual designated password for the user **102** or a modified password) can be entered through any combination of user input devices such as for example, a keyboard or a displayed user interface (e.g., through a keyboard or portion thereof presented on a display of the local computing device **104**). In various embodiments, a keyboard or portion thereof can be displayed on a display of the local computing device **104** allowing the user **102** to enter a password through, for example, a touchscreen or through mouse clicks when positioned over the displayed keys of the keyboard.

By using modified keyboard configurations, the operating environment **100** provides safe password protection. An individual looking at the user **102** entering the modified password or recording it (e.g., through key logging), will see the modified password entered (or will record the modified password). Since the unscrupulous individual is not aware of the modified keyboard configuration, the individual will not be able to use the information to login using the information of the user **102**. As a result, the password of the user **102** is protected.

FIG. **2**A illustrates a first keyboard modification **200**. Keyboard **202** can represent a portion of a standard keyboard configuration (e.g., a QWERTY keyboard configuration). The keyboard **202** can include a first column of characters **204** and a second column of characters **206**. The first column of characters **204** can include the characters "W," "S," and "X" as shown. The second column of characters **206** can include the characters "E," "D," and "C" as shown. Keyboard **208** can represent a modified keyboard. The keyboard **208** can result when the characters of the first and second columns **204** and **206** are shifted over by a column—for example, shifted to the right (with respect to the columns as oriented in FIG. **2**). As a result, for keyboard **208**, the column **206** now includes the characters "W," "S," and "X" as shown and the column **204** now includes the characters "Q," "A," "Z" as shown (e.g., the characters in the column to the left of the column **204** for the keyboard **202**).

A user that has a password of "W," "S," and "X" would select the characters from the first column **204** when the keyboard **202** is the basis for password entry. However, when the keyboard **208** is the basis for password entry, the user having a password of "W," "S," and "X" would select the characters from the second column **206** (i.e., "E," "D," and "C") due to the shift in configuration of the keyboard **208** relative to the keyboard **202**.

In general, the techniques described herein enable any shifting, movement, or change in the location of any character of a keyboard to form a modified keyboard configuration. Further, the modifications can be considered to be virtual modifications to a keyboard and not a physical change in the keys. That is, the modifications indicate how entered keys are to be interpreted by the remote computing system **106**.

FIG. **2**B illustrates a second keyboard modification **210**. Keyboard **212** can represent a portion of a standard keyboard configuration (e.g., a QWERTY keyboard configuration). The keyboard **212** can include a first row of characters **214** and a second row of characters **216**. The first row of characters **214** can include the characters "W," "E," and "R" as shown. The second row of characters **216** can include the characters "S," "D," and "F" as shown. Keyboard **218** can represent a modified keyboard. The keyboard **218** can result when the characters of the first and second rows **214** and **216** are shifted down by a row—for example, shifted downward (with respect to the rows as oriented in FIG. **2**B). As a result, the row **216** now includes the characters "W," "E," and "R" as shown and the row **214** now includes the characters "2," "3," "4" as shown (e.g., the characters in the row above the row **214** for the keyboard **212**).

A user that has a password of "W," "E," and "R" would select the characters from the first row **214** when the keyboard **212** is the basis for password entry. However, when the keyboard **218** is the basis for password entry, the user having a password of "W," "E," and "R" would select the characters from the second row **216** (i.e., "S," "D," and "F") due to the shift in configuration of the keyboard **218** relative to the keyboard **202**. The remote computing system **106** can receive indications that the keys "S," "D," and "F" were entered by the user **102**. The remote computing system **106** can then convert the received characters back to "W," "E," and "R" based on the known modification to the keyboard **212** that forms the keyboard **218**. As such, a user entering "S," "D," and "F" using the keyboard **218** is converted into "W," "E," and "R" by the remote computing device **106**.

FIG. **3** illustrates an example of a logic flow **300** that may be representative of techniques for providing password protection. For example, the logic flow **300** may be representative of operations that may be performed in various embodiments by any constituent component of the operating environment **100** depicted in FIG. **1**.

At **302**, a user (e.g., the user **102**) can define one or more modified keyboard configurations from a computing device (e.g., the local computing device **104**). The modified keyboard configurations can be defined at a time when the user creates an account with a website (e.g., hosted or provided by the remote computing system **106**). The modified keyboard configurations can be defined when the user operates a secure computing device and/or operates a computing device over a secure network. The modified keyboard configurations can be distinguished based on names or other identifications (e.g., a picture) specified by the user.

At **304**, at a time subsequent to defining the modified keyboard configurations (e.g., at a later time for logging into the website using a user ID and password defined when the user creates the user account), the website can detect that the user is operating a public computer.

At **306**, based on the detection that the user is interacting with the website from a non-secure computing device, the website can select one of the modified keyboard configurations defined by the user at **302**. The website can identify the user based on the provided user ID. The account for the user can then be reviewed to determine a stored password for the user and the modified keyboard configurations associated with the user.

At **308**, in response to the user attempting to login to the website and/or in response to the user providing a user login ID, the website can request a password from the user based on the selected modified keyboard configuration. The selected modified keyboard configuration can be indicated to

the user—e.g., by name and/or by other means such as a graphic associated with the selected modified keyboard configuration. In some embodiments, the modification may be selected based on input received from a secondary device where the user has been authenticated. For example, the user may select a first modified keyboard configuration from a plurality of different modified keyboard configurations presented in a graphical user interface on the secondary device. As another example, the user may select one of the plurality of different modified keyboard configurations by providing input during a phone call to the secondary authenticated device. As yet another example, the user may select one of the plurality of different modified keyboard configurations responsive to a text message sent to the secondary authenticated device. As yet another example, the user may select one of the plurality of different modified keyboard configurations via a smartphone application that presents the plurality of different modified keyboard configurations for selection.

At **310**, the website receives the modified password from the user—that is, the password for the user based on the modified keyboard configuration indicated in **308**.

At **312**, the website can revert the modified password into a password corresponding to a standard keyboard configuration to generate a converted password. The converted password can then be compared to the actual password for the user established when the user defined the password using the standard keyboard configuration.

At **314**, the website can authorize the user to access the website based on whether the converted password matched the actual password. If the converted password did not match the actual password, then the user can be blocked from accessing the website. If the converted password did match the actual password defined and stored for the user, the user can be authorized to access the website.

FIG. **4** illustrates a storage medium **400**. Storage medium **400** may represent an implementation of a storage device of any computing device that may operate within the operating environment **100** of FIG. **1**. The storage medium **400** can comprise any non-transitory computer-readable storage medium or machine-readable storage medium. In various embodiments, the storage medium **400** can comprise a physical article of manufacture. In various embodiments, storage medium **400** can store computer-executable instructions, such as computer-executable instructions to implement one or more of logic flows or operations described herein, such as the logic flow **300** of FIG. **3**. In various embodiments, storage medium **400** can store computer-executable instructions, such as computer-executable instructions to implement any of the functionality described herein in relation to any described device, system, or apparatus. Examples of a computer-readable storage medium or machine-readable storage medium can include any tangible media capable of storing electronic data. Examples of computer-executable instructions can include any type of computer readable code.

FIG. **5** illustrates a computing architecture **500** that can implement various embodiments described herein. In various embodiments, the computing architecture **500** can comprise or be implemented as part of an electronic device and/or a computing device. In various embodiments, the computing architecture **500** can represent an implementation of any constituent component of the operating environment **100** depicted in FIG. **1**. One or more of the constituent components of the computing architecture **500** and/or any constituent component of the operating environment **100** can be implemented in hardware, software, or any combination thereof including implementation based on a storage device (e.g., a memory unit) and logic, at least a portion of which is implemented in circuitry and coupled to the storage device. The logic can be or can include a processor or controller component such as, for example, a processor or controller that executes code stored in the storage device.

The computing architecture **500** can include various common computing elements, such as one or more processors, multi-core processors, co-processors, memory units, chipsets, controllers, peripherals, interfaces, oscillators, timing devices, video cards, audio cards, multimedia input/output (I/O) components, power supplies, and so forth.

As shown in FIG. **5**, the computing architecture **500** can comprise a computer **502** having a processing unit **504**, a system memory **506** and a system bus **508**. The processing unit **504** can be any of various commercially available processors or can be a specially designed processor.

The system bus **508** provides an interface for system components including, but not limited to, an interface between the system memory **506** and the processing unit **504**. The system bus **508** can be any of several types of bus structure that may further interconnect to a memory bus (with or without a memory controller), a peripheral bus, and a local bus using any of a variety of commercially available bus architectures.

The system memory **506** can include any type of computer-readable storage media including any type of volatile and non-volatile memory. The computer **502** can include any type of computer-readable storage media including an internal (or external) hard disk drive (HDD) **514**. In various embodiments, the computer **502** can include any other type of disk drive such as, for example, a magnetic floppy disk and/or an optical disk drive. The HDD **514** can be connected to the system bus **508** by an HDD interface **524**.

In various embodiments, any number of program modules can be stored in the drives and memory units **506** and/or **514** such as, for example, an operating system **530**, one or more application programs **532**, other program modules **534**, and program data **536**.

A user can enter commands and information into the computer **502** through one or more wired/wireless input devices such as for example, a keyboard **538** and a pointing device, such as a mouse **540**. These and other input devices can be connected to the processing unit **504** through an input device interface **542** that is coupled to the system bus **508**. A monitor **544** or other type of display device can also be connected to the system bus **508** via an interface, such as a video adaptor **546**. The monitor **544** may be internal or external to the computer **502**.

The computer **502** may operate in a networked environment using logical connections via wired and/or wireless communications to one or more remote computers, such as a remote computer **548**. The remote computer **548** can be a workstation, a server computer, a router, a personal computer, portable computer, microprocessor-based entertainment appliance, a smartphone, a tablet, a peer device or other common network node, and typically includes many or all of the elements described relative to the computer **502**. The logical connections depicted include wired and/or wireless connectivity to networks **552** such as, for example, a local area network (LAN) and/or larger networks, for example, a wide area network (WAN). Networks **552** can provide connectivity to a global communications network such as, for example, the Internet. A network adapter **556** can facilitate wired and/or wireless communications to the networks **552**. The computer **502** is operable to communicate over any known wired or wireless communication

technology, standard, or protocol according to any known computer networking technology, standard, or protocol.

FIG. **6** illustrates a block diagram of a communication architecture **600**. The communication architecture **600** can implement various embodiments described herein. As shown in FIG. **6**, the communication architecture **600** comprises one or more clients **602** and servers **604**. One of the clients **602** and/or one of the servers **604** can represent any constituent component of the operating environment **100** depicted in FIG. **1**.

The client **602** and the server **604** can be operatively connected to a client data store **608** and a server data store **610**, respectively, that can be employed to store information local to the respective client **602** and server **604**. In various embodiments, the client **602** and/or the server **604** can implement one or more of logic flows or operations described herein.

The client **602** and the server **604** can communicate data or other information between each other using a communication framework **606**. The communications framework **606** can implement any known communications technique or protocol. The communications framework **606** can be implemented as a packet-switched network (e.g., public networks such as the Internet, private networks such as an enterprise intranet, and so forth), a circuit-switched network (e.g., the public switched telephone network), or a combination of a packet-switched network and a circuit-switched network (with suitable gateways and translators), or any combination thereof. The communications framework **606** can operate over any communication media according to any networking technology including any wired or wireless communications standard or protocol, or any combination thereof.

The following set of first examples pertain to further embodiments.

Example 1 is a computing device comprising a storage device and logic, at least a portion of the logic implemented in circuitry coupled to the storage device, the logic to receive user identification data from a remote computing device, determine an identity of a user based on the user identification data, determine a password for the user stored in the storage device, determine a modified keyboard configuration associated with the user stored in the storage device, transmit a request to the remote computing device for the password for the user based on the modified keyboard configuration, receive a modified password from the remote computing device, determine a converted password based on the modified password and the modified keyboard configuration, compare the converted password to the password for the user, and authorize the user when the converted password matches the password for the user.

Example 2 is an extension of Example 1 or any other example disclosed herein, the request to indicate an identification of the modified keyboard configuration.

Example 3 is an extension of Example 1 or any other example disclosed herein, the logic to determine the remote computing device is a public remote computing device.

Example 4 is an extension of Example 3 or any other example disclosed herein, the logic to determine the remote computing device is a public remote computing device by comparing a received Internet Protocol (IP) address to an IP associated with the user stored in the storage device.

Example 5 is an extension of Example 1 or any other example disclosed herein, the modified keyboard configuration comprising a reassignment of keyboard keys for a standard keyboard configuration.

Example 6 is an extension of Example 5 or any other example disclosed herein, the reassignment of keyboard keys comprising a one-to-one reassignment of all keyboard keys for the standard keyboard configuration.

Example 7 is an extension of Example 5 or any other example disclosed herein, the reassignment of keyboard keys comprising a one-to-one reassignment of a subset of all keyboard keys for the standard keyboard configuration.

Example 8 is a method performing any of the steps or functions (e.g., performed by the logic of the computing device) recited in any of the Examples 1-7.

Example 9 is at least one non-transitory computer-readable medium comprising a set of instructions that, in response to being executed on a computing device, cause the computing device to implement any of the steps of functions (e.g., performed by the logic of the computing device) recited in any of the Examples 1-7.

Various embodiments described herein may comprise one or more elements. An element may comprise any structure arranged to perform certain operations. Each element may be implemented as hardware, software, or any combination thereof. Any reference to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment. The appearances of the phrases "in one embodiment," "in some embodiments," and "in various embodiments" in various places in the specification are not necessarily all referring to the same embodiment.

In various instances, for simplicity, well-known operations, components, and circuits have not been described in detail so as not to obscure the embodiments. It can be appreciated that the specific structural and functional details disclosed herein may be representative and do not necessarily limit the scope of the embodiments.

Certain embodiments of the present invention were described above. It is, however, expressly noted that the present invention is not limited to those embodiments, but rather the intention is that additions and modifications to what was expressly described herein are also included within the scope of the invention. Moreover, it is to be understood that the features of the various embodiments described herein were not mutually exclusive and can exist in various combinations and permutations, even if such combinations or permutations were not made express herein, without departing from the spirit and scope of the invention. In fact, variations, modifications, and other implementations of what was described herein will occur to those of ordinary skill in the art without departing from the spirit and the scope of the invention. As such, the invention is not to be defined only by the preceding illustrative description.

The invention claimed is:

1. A method, comprising:

determining a password for an account;

determining an Internet Protocol (IP) address of a device does not match an IP address associated with the account;

determining, based on the determination that the IP address of the device does not match the IP address associated with the account, a modified keyboard configuration associated with the account;

receiving a modified password from the device, the modified password based on the modified keyboard configuration;

determining a converted password based on the modified password and the modified keyboard configuration; and

authorizing access to the account when the converted password matches the password for the account.

2. The method of claim 1, wherein the password is determined based on identification data received from the device.

3. The method of claim 1, further comprising prior to determining the modified keyboard configuration:

determining, based on the IP address of the device, that the device is a public computing device, wherein the modified keyboard configuration is further determined based on the determination that the device is a public computing device.

4. The method of claim 1, further comprising:

transmitting a request to the device for the password based on the modified keyboard configuration.

5. The method of claim 1, further comprising:

transmitting an indication of the modified keyboard configuration to the device, the modified keyboard configuration comprising a reassignment of keyboard keys for a first keyboard configuration.

6. The method of claim 5, the reassignment of keyboard keys comprising a one-to-one reassignment of all keyboard keys for the first keyboard configuration.

7. The method of claim 1, further comprising prior to determining the modified keyboard configuration:

receiving input selecting the modified keyboard configuration; and

determining a number of times the modified keyboard configuration has been used do not exceed a threshold.

8. A non-transitory computer-readable storage medium storing instructions that when executed by a processor, cause the processor to:

determine a password for an account;

determine an Internet Protocol (IP) address of a device does not match an IP address associated with the account;

determine, based on the determination that the IP address of the device does not match the IP address associated with the account, a modified keyboard configuration associated with the account;

receive a modified password from the device, the modified password based on the modified keyboard configuration;

determine a converted password based on the modified password and the modified keyboard configuration; and

authorize access to the account when the converted password matches the password for the account.

9. The computer-readable storage medium of claim 8, wherein the password is determined based on identification data received from the device.

10. The computer-readable storage medium of claim 8, storing instructions that when executed by the processor, cause the processor to:

determine, based on the IP address of the device, that the device is a public computing device, wherein the modified keyboard configuration is further determined based on the determination that the device is a public computing device.

11. The computer-readable storage medium of claim 8, storing instructions that when executed by the processor, cause the processor to:

transmit a request to the device for the password based on the modified keyboard configuration.

12. The computer-readable storage medium of claim 8, storing instructions that when executed by the processor, cause the processor to:

transmit an indication of the modified keyboard configuration to the device, the modified keyboard configuration comprising a reassignment of keyboard keys for a first keyboard configuration.

13. The computer-readable storage medium of claim 12, the reassignment of keyboard keys comprising a one-to-one reassignment of all keyboard keys for the first keyboard configuration.

14. The computer-readable storage medium of claim 8, storing instructions that when executed by the processor, cause the processor to, prior to determining the modified keyboard configuration:

receive input selecting the modified keyboard configuration; and

determine a number of times the modified keyboard configuration has been used do not exceed a threshold.

15. An apparatus comprising:

a processor; and

a memory storing instructions that, when executed by the processor, cause the processor to:

determine a password for an account;

determine an Internet Protocol (IP) address of a device does not match an IP address associated with the account;

determine, based on the determination that the IP address of the device does not match the IP address associated with the account, a modified keyboard configuration associated with the account;

receive a modified password from the device, the modified password based on the modified keyboard configuration;

determine a converted password based on the modified password and the modified keyboard configuration; and

authorize access to the account when the converted password matches the password for the account.

16. The apparatus of claim 15, wherein the password is determined based on identification data received from the device.

17. The apparatus of claim 15, the memory storing instructions that when executed by the processor, cause the processor to:

determine, based on the IP address of the device, that the device is a public computing device, wherein the modified keyboard configuration is further determined based on the determination that the device is a public computing device.

18. The apparatus of claim 15, the memory storing instructions that when executed by the processor, cause the processor to:

transmit a request to the device for the password based on the modified keyboard configuration.

19. The apparatus of claim 15, the memory storing instructions that when executed by the processor, cause the processor to:

transmit an indication of the modified keyboard configuration to the device, the modified keyboard configuration comprising a reassignment of keyboard keys for a first keyboard configuration.

20. The apparatus of claim 15, the memory storing instructions that when executed by the processor, cause the processor to, prior to determining the modified keyboard configuration:

receive input selecting the modified keyboard configuration; and

determine a number of times the modified keyboard configuration has been used do not exceed a threshold.

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